KLMN Natural Resources Database
Database Design Description Manual

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Document Changes and Revisions			
Date	Document Version	Page	Change Description
4/12/2005	0.1a	this page	added this table, renumbered TOC to ii
		5,14	Table 1 and Table 14: deleted "DATABASE_NAME", added "Database_LongName" and "Database_ShortName"; deleted reference to "Retrieval_Form"
		3	added reference to Software Version Description document
4/13/2005	0.1a		Added a new table/section for "tbl_Database_Reports" to section 4.1.1. Renumbered tables and pages as needed.
4/18/2005	0.1b	21	Table 23, changed Protocol_Name to Protocol_Id, data type to Replication ID
6/8/2005	2.0	All	Reformatted the entire document
6/11/05	2.0	All	All graphics have been converted to jpg images

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1 Scope

1.1 Identification

This Database Design Description document applies to the database design and table structures which comprise a portion of software product identified as the Klamath Inventory and Monitoring Network Natural Resources Database.

1.2 System overview

The Klamath Inventory and Monitoring Natural Resources Database represents a standardized set of database tables, structures, field definitions and user interface displays operating is a some what coherent fashion. The software and data structures comprising this Natural Resources Database (NRD) are contained within two separate but tightly coupled MS Access database files utilizing the JET database manager. This design is a modification of the classic two tier design that is commonly referred to as a "back-end" and "front-end". The classic two-tier design identifies separate database and user interface layers whereas this design consists of a separate database layer and mixed database/user interface layer thru the use of linked database tables within the user interface layer. Figure 1 System overview depicts this relationship. This figure illustrates three connected back-end databases; however the front end can accommodate hundreds of compatible "back-end" databases.
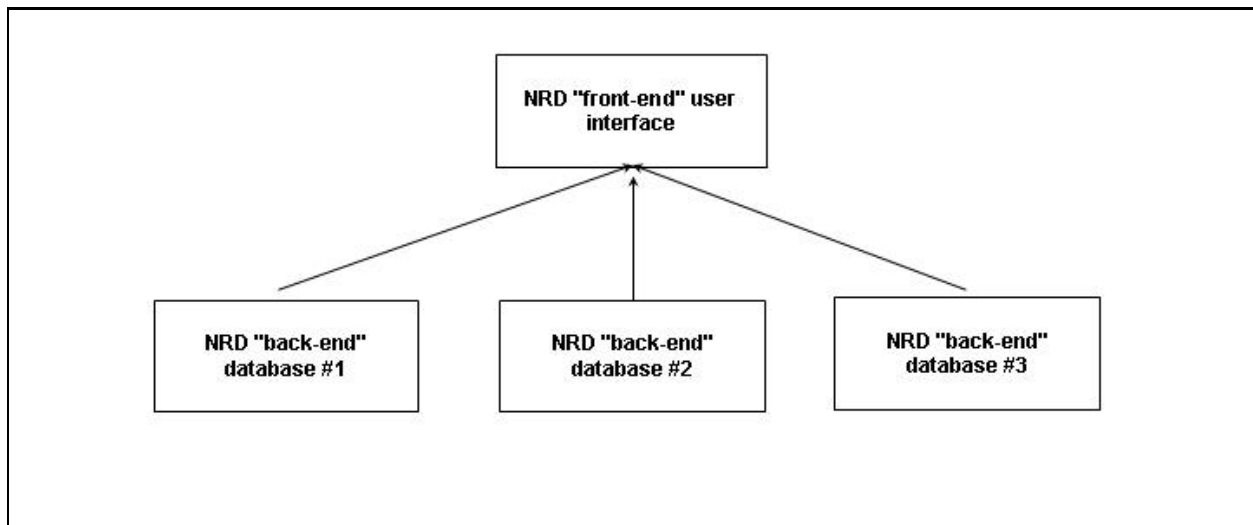
Figure 1 System overview

The NRD "front-end" user interface accesses the contents of the "back-end" database primarily thru the linking of "back-end" tables into the "front-end". This process is moderated by software in the "front-end" which performs the linking of "back-end" objects into the "front-end" by accessing a list of objects identified in the "back-end" "`tbl_Database_Link_Items`" table. This process occurs when the user selects and links to a 'back-end" database. Figure 2 Front-end/back-end linkages illustrate the tables involved in this process.

1.3 Document overview

The purpose of this document is to convey design information to the development and support community. Detailed design information about the Natural Resources Database is documented within. Specific information regarding the software involved, installation information, operating environment and operation and use of the user interface is outside the scope of this document and is contained within the *Klamath Network Inventory and Monitoring Natural Resources Database - Software User Manual*.

2 Database-wide design decisions

Several factors were involved in the design process for the NRD. The major ones are as follows:

a. Conformance to the national I & M Program's NRDT V3 recommended design.

b. Conformance to the Klamath Network Site Information Data Dictionary.

c. Ability to operate with a number of natural resource datasets containing disparate data.

d. Resulting software and database structures must be managed via MS Access.

The national I & M Program's NRDT V3 recommended design may be referenced in the *Natural Resource Database Template Version 3 Documentation.*

The Klamath Network Site Information Data Dictionary identifies a set of information to be collected in the field for each collection site visited. For more information, please refer to the *Data Dictionary for KPN Site Information Form.*

The combination of the above two items, results in a database design which standardizes most of the information collected during field operations and helps insure the future aggregation of research data into larger databases. The design documented herein does not attempt to standardize or identify data specific to field studies, such as bats, vegetation, etc.

Item "c" from above is directly addressed thru the use of "n" number of "back-end" database files, each containing identical database structures for all tables EXCEPT for specific field data.

This is illustrated in both Figure 1 System overview and Figure 2 Front-end/back-end linkages.
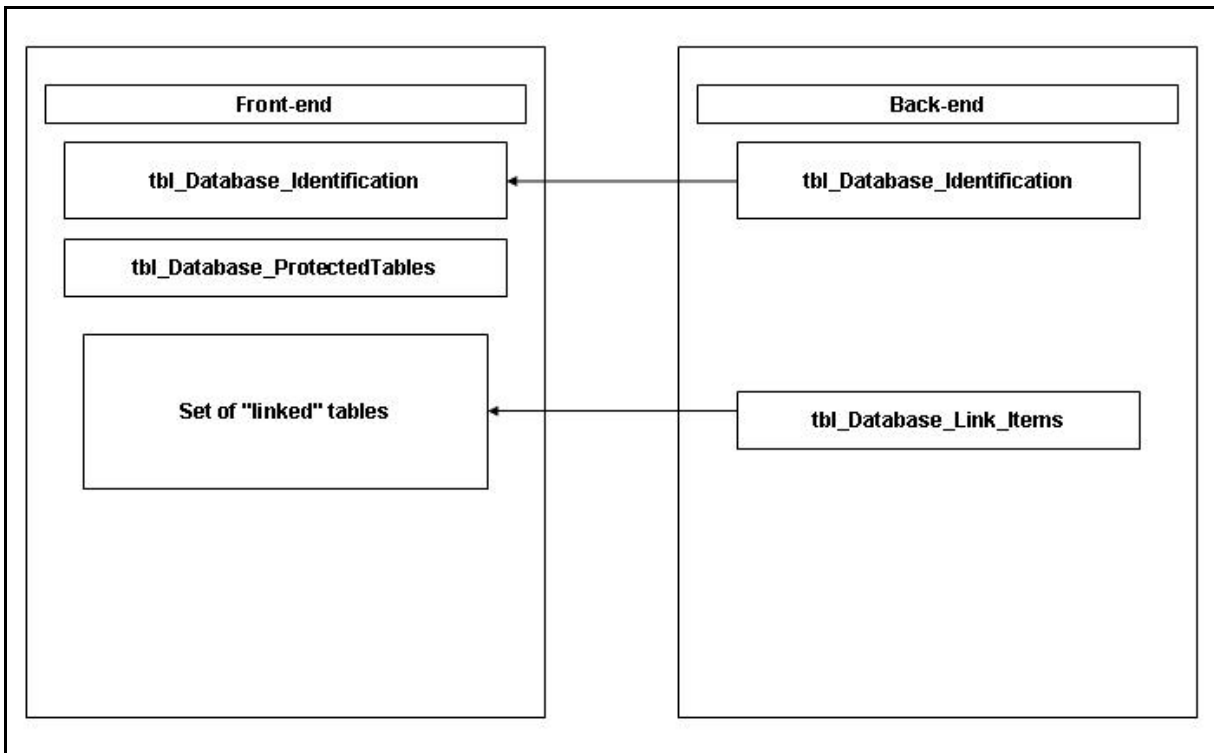
Figure 2 Front-end/ back-end linkages

3 Detailed design of the database

As identified in previous sections, the KLMN NRD is divided into two components, the "front-end", which contains the user interface, and the "back-end" which contains the data. Each of these is described in detail in section 4.1 and section 4.2.

3.1 Front-end database design

3.1.1 Front-end database tables

The following sections describe those tables that are resident in the "front-end" database. Linked tables are described in section 4.2.

3.1.1.1 Database table: tbl_Database_Identification

This table is used to keep track of identified "back-end" databases. Specific information saved consists of database name, directory path, file name, user interface forms to associate with and a flag to indicate which database has been selected for use. Records are added, modified or

deleted by accessing the **FILE --> NEW/EDIT** function from the main user display located in the "front-end" database/user interface. This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Database_ID	Replication ID	16	Unique Record Identifier
Database_LongName	Text	100	Long or full Name of this database, this is used for report titles
Database_ShortName	Text	20	Short name of this database, used to identify the database on front end user displays.
Database_Path	Text	250	Full Path Name excluding the database file name; EX: C:\Databases\
Database_FileName	Text	50	Name of the MDB database EX: Bat_Guano.mdb
FieldData_Form	Text	50	Name of the root or primary date entry form for database specific field data.
Current_Database	Text	1	Set to TRUE if this is the currently linked database

Table 1 tbl_Database_Identification schema

3.1.1.2 Database table: tbl_Database_ProtectedTables

This is a special "system type" table. It is used to define those "front-end" tables that are inviolate and are not to be deleted by the user interface software tasked with linking "back-end" databases. Any tables that are NOT to be removed MUST be identified in this table; otherwise they will be vaporized upon the next database link operation. This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique record Identifier
Table_Name	Text	50	Name Of Table That is not auto-deletable

Table 2 tbl_Database_ProtectedTables schema.

3.1.1.3 Database table: tbl_Database_Reports

This is a special "system type" table. It is used to define available reports for ALL databases which either use generic reports or have special or database unique reports.   Those reports which are specific to a particular "back-end" database MUST be identified by including the "Database_ShortName" field value identified in Table 15 tbl_Database_Identification schema. Generic reports MUST have a value of "**ALL**" in the "Database_ShortName" field.

The "Display_Order" field contains an incremental number that is used by the extraction query to order the returned records for display in a desired sequence.

This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique record Identifier
Report_Description	Text	50	Name of report for information retrieval form
Report_Name	Text	50	Internal name for this report.
Database_ShortName	Text	50	Short name database to which this report applies or ALL for generic reports
Display_Order	Long Integer	4	Display order

Table 3 tbl_Database_Reports schema

3.1.1.4 Database table: tbl_DB_Revisions_FE

This table is used to keep track of modifications to the structure of the "front-end" database, user interface, reports, software modules and queries. Revisions and modifications should be tracked faithfully once the database has been base-lined and configuration management procedures are activated. Additions should only occur when STRUCTURAL changes are made to the associated "back-end" database. Please do not use it to identify additions or modifications of the DATA in the database. This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Revision_ID	Replication ID	16	Unique record Identifier
Revision_Contact_ID	Replication ID	16	Contact ID for the person doing the revision
DB_Meta_ID	Replication ID	16	Pointer to a tbl_DB_Meta record
Revision_Date	Date/Time	8	Database revision date
Revision_Reason	Memo	-	Reason for the database revision
Revision_Desc	Memo	-	Revision description
Revision_Major	Text	5	Major revision number or code - ex: Revision 4.31 ; 4 = Major, 31 = Minor
Revision_Minor	Text	5	Minor revision number or code - ex: Revision 4.31 ; 4 = Major, 31 = Minor

Table 4 tbl_DB_Revisions_FE schema

3.1.1.5 Database table: tlu_Enumerations_Events

The "tlu_Enumerations_Events" table is a look-up table containing codes and definitions that are used to qualify data entry values for the data entry form "Events". Data from this table is obtained thru the use of pre-defined queries that extract records based on the values in the "Group" field.

Currently this table contains enumeration values for the following categories:

- Major_Class
- Sub_Class
- Event_Type

Major_Class records form the root of a dual tree structured set of data. A specific Major_Class record may have "n" number of Sub_Class and Event_Type records. Data extraction for these

requires use of a parameterized data retrieval query. This is accomplished in the "code-behind" portion of the Events data entry display. As the value in the field containing the Major_Class, changes, the Sub_Class and Event_Type drop down lists are re-populated with only those values that are valid for the selected Major_Class. The records in this enumeration table may be extended or modified, providing the tree structure is maintained.

The "List_Order" field may contain an incremental number that is used by the extraction query to order the returned records for display in whatever sequence is desired.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique Record Identifier
Code	Text	50	Coded Value to Be Stored In Database
Description	Text	150	Brief Description Of Code
Group	Text	50	Grouping Identifier i.e. Park Codes, Cloud Cover etc
List_Order	Long Integer	4	Sort Order for Display Purposes

Table 5 tlu_Enumerations_Events schema

Group Name	Description
EncounterClass	List of sampling survey types for tbl_Events
Major_Class	Major Classification Codes
Sub_Class:BIRD	Sub-classification codes for Birds
Sub_Class:HERP	Sub-classification codes for slimy amphibian types
Sub_Class:MAMM	Sub-classification codes for mammal types
Sub_Class:FISH	Sub-classification codes for fishies
Sub_Class:NPLT	Sub-classification codes for non-vascular plants
Sub_Class:VPLT	Sub-classification codes for vascular plants
Event_Type:INV	Sampling event type for spineless critters
Event_Type:BIRD	Sampling event type for modern theropods
Event_Type:HERP	Sampling event type for herps
Event_Type:MAMM	Sampling event type for mammals
Event_Type:FISH	Sampling event type for fishies
Event_Type:NPLT	Sampling event type for non-vascular plants
Event_Type:VPLT	Sampling event type for vascular plants

Table 6 tlu_Enumerations_Events group categories

3.1.1.6 Database table: tlu_Enumerations_FieldData

At the present, this table is empty, and not used. It is included as a reference for any future needs. It is intended to be the repository for any field data specific field qualifiers or enumeration values for field data tables. The best usage for this is to store the qualifiers or enumeration values in this table and extract them via query as is performed with the other enumeration tables. These queries could then be used to populate drop-down list boxes or other data entry fields.

The "List_Order" field may contain an incremental number that is used by the extraction query to order the returned records for display in whatever sequence is desired.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique Record Identifier
Code	Text	50	Coded Value to Be Stored In Database
Description	Text	150	Brief Description Of Code
Group	Text	50	Grouping Identifier i.e. Park Codes, Cloud Cover etc
List_Order	Long Integer	4	Sort Order for Display Purposes

Table 7 tlu_Enumerations_FieldData schema

3.1.1.7 Database table: tlu_Enumerations_General

This table is identical in design to the previously described enumerations tables. This particular table is intended to be used to support look-up data for a variety of displays other than Events, Field Data or Site Data. Data must be extracted from this table thru the use of a pre-defined "static" or a parameterized query.

The "List_Order" field may contain an incremental number that is used by the extraction query to order the returned records for display in whatever sequence is desired.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique Record Identifier
Code	Text	50	Coded Value to Be Stored In Database
Description	Text	150	Brief Description Of Code
Group	Text	50	Grouping Identifier i.e. Park Codes, Cloud Cover etc
List_Order	Long Integer	4	Sort Order for Display Purposes

Table 8 tlu_Enumerations_General schema

Group Name	Description
Address_Type	List of address types for tbl_Contacts
Contact_Role	List of personnel activities for xref_Event_Contacts
Coord_System	List of relevant coordinate systems for tbl_Locations
Datum_Year	List of relevant datum years for tbl_Locations
Datum_Zone	List of relevant UTM zones for tbl_Locations
Document_Category	List of Nature Bib categories for tbl_Documents

Table 9 tlu_Enumerations_General group categories

3.1.1.8 Database table: tlu_Enumerations_SiteData

This table is used to contain enumeration data for ALL site data information such as weather, topography, etc. Data is extracted by pre-defined queries and placed in various drop-down lists. Refer to the actual contents of this table for further clarification. The contents may be modified as needed.

The "List_Order" field may contain an incremental number that is used by the extraction query to order the returned records for display in whatever sequence is desired.

Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique Record Identifier
Code	Text	50	Coded Value to Be Stored In Database
Description	Text	150	Brief Description Of Code
Group	Text	50	Grouping Identifier i.e. Park Codes, Cloud Cover etc
List_Order	Long Integer	4	Sort Order for Display Purposes

Table 10 tlu_Enumerations_SiteData schema.

Group Name	Description
CloudCover	List of cloud coverage's for tbl_Site_Data_Weather
Precipitation	List of precipitation categories for tbl_Site_Data_Weather
Wind	List of wind classifications for tbl_Site_Data_Weather
StratumClass_1	List of climate zones for tbl_Site_Data
StratumClass_2	List of elevation zones for tbl_Site_Data
PlotShape	List of geometric plot shapes for tbl_Site_Data_Topography
SlopeShape	List of slope shapes for tbl_Site_Data_Topography
Topography	List of general topographic classes for tbl_Site_Data_Topography
PhysiognomicClass	List of physiognomy classes for tbl_Site_Data_VegStratum
HeightClass	List of standardized height classifications for tbl_Site_Data_VegStratum
PercentCoverage	List of standardized coverage categories for tbl_Site_Data_VegStratum

Table 11 tlu_Enumerations_SiteData group categories

3.1.1.9 Database table: tlu_Networks

This table contains a list of NPS Inventory and Monitoring networks.

Field Name	Data Type	Size	Description
Network_Name	Text	100	Complete official network identification
Network_Code	Text	5	Official network unit code
Network_Number	Double	8	Official network code number

Table 12 tlu_Networks schema

3.1.1.10 Database table: tlu_Parks

This table contains a list of all National Park Units and their associated I & M network.

Field Name	Data Type	Size	Description
Park_Code	Text	4	Four-letter abbreviation
Park_Name	Text	100	Name of the park, without "National Park" or equivalent
Park_Type_Code	Text	10	"NP", "NS", "NHP", etc.
Park_Type	Text	50	"National Park", "National Seashore", etc.
Network_Code	Text	4	Code for the I&M network
Region	Text	4	Code for the NPS region

Table 13 tlu_Parks schema

3.1.1.11 Database table: tlu_StateCodes

Complete listing of all states and territories along with their standard postal abbreviations.

Field Name	Data Type	Size	Description
State	Text	50	State or territory
Abbreviation	Text	20	State Abbreviations
PostalCode	Text	20	Unique State Postal Code.

Table 14 tlu_State_Codes schema

3.2 Back-end database design

The "back-end" database contains the data used by the "front-end".   Data is segregated into tables based on commonality of the data and relationships based on various indexes are used to connected related records. These relationships and linkages are depicted in <u>Figure 3 Primary data table relationships</u>. Details regarding the structures of each table are described in the following sections.

3.2.1 Back-end database tables

The "back-end" database is the container for Inventory or Monitoring project data. This data is organized into a number of inter-related data tables, depicted in <u>Figure 3 Primary data table relationships.</u> As can be seen in the figure, the primary, or root table is the `"tbl_Events"` table. Its main purpose is to "connect" the contents of the various tables to a specific sampling event. There are three indices or pointers used to provide the primary linkage between the `"tbl_Events"` table and the remainder of the tables.

 The `"Location_Id"` linkage pointer serves to connect one event record with one particular record in the `"tbl_Locations"` table. The `"Event_Group_ID"` serves to connect a single sampling event, identified as a single record in `"tbl_Events"` to a cluster or group of related events. And lastly, `"Event_ID"` connects a particular sampling event with its associated site data, field data, QC details and crew. A one-to-one relationship exists between `"tbl_Events"` and the first three, while a one-to-many relationship exists between `"tbl_Events"` and `"xref_Event_Contacts"` tables. There are other tables involved in the "back-end" database that have been omitted from Figure 3 for clarity. They are, however, described along with their relationships, in subsequent sections.
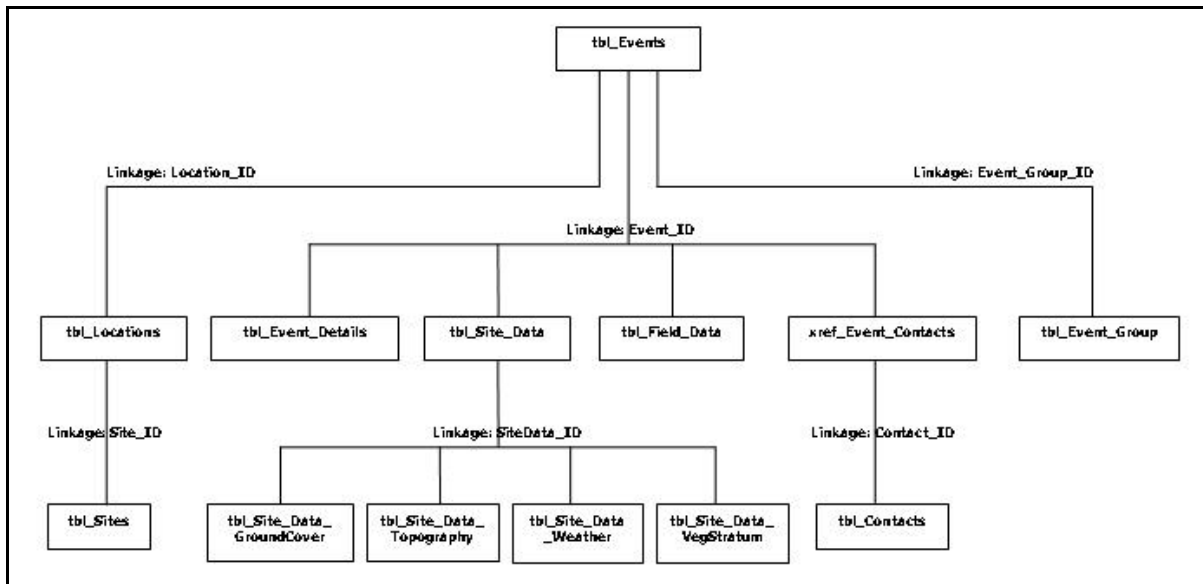
Figure 3 Primary data table relationships

3.2.1.1 Database table: tbl_Database_Identification

This table is used to identify to the "front-end" component, specific information about the contents of the "back-end" database which are used to integrate field data entry forms and information retrieval. The "front-end" has the ability to identify the "back-end" database currently in use thru a short descriptive name, such as Bats, Herps, Rodentia, etc. contained in the field `"Database_Name"`. The user is free to identify the database as he/she sees fit.   This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Database_LongName	Text	100	Long or full Name of this database, this is used for report titles
Database_ShortName	Text	20	Short name of this database, used to identify the database on front end user displays.
FieldData_Form	Text	50	Name of the root or primary date entry form for database specific field data.

Table 15 tbl_Database_Identification schema.

3.2.1.2 Database table: tbl_Database_Link_Items

This table is used by the "front-end" layer to identify those database objects to which it must link in order to properly retrieve data. A standard set of objects are included in this table for all of the "standard" tables. Tables which are used to contain survey specific field data must be added by the individual responsible for adding or modifying the field data tables and the corresponding records added or modified in this table. This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Record_ID	Replication ID	16	Unique Record Identifier
Object_Name_Source	Text	50	Name of Object in back end database
Object_Name_Linked	Text	50	Name of Back End Object in front end database
Object_Type	Text	50	Type of Database Item - Table, Form, etc

Table 16 tbl_Database_Link_Items schema

3.2.1.3 Database table: tbl_Contacts

This table should be self explanatory; it is used to contain information about individuals involved in collecting or processing the data within the database. Not all of the fields are required, however a person's first and last names and organization are best specified. Several other tables link to this table thru the "Contact_ID" field. Figure 4 Relationships for tbl_Contacts, illustrates these connections.

| Field Name	Data Type	Size	Description
Contact_ID	Replication ID	16	Contact Identifier
Last_Name	Text	50	Last Name
First_Name	Text	50	First Name
Middle_Init	Text	4	Middle Initial
Organization	Text	255	Organization or employer
Position_Title	Text	50	Title or position description
Address_Type	Text	50	Address type (mailing, physical, both)
Address	Text	255	Street Address
Address2	Text	255	Address Line 2, suite, apartment number, mail stop
City	Text	50	City or town
State_Code	Text	2	State or province
Zip_Code	Text	10	Zip code
Country	Text	50	Country
Email_Address	Text	50	e-mail address
Work_Phone	Text	20	phone number
Work_Extension	Text	5	phone extension
Cell_Phone	Text	50	Cell Phone Number
Fax_Number	Text	20	Fax Number
Contact_Notes	Memo	-	Contact notes

Table 17 tbl_Contacts schema
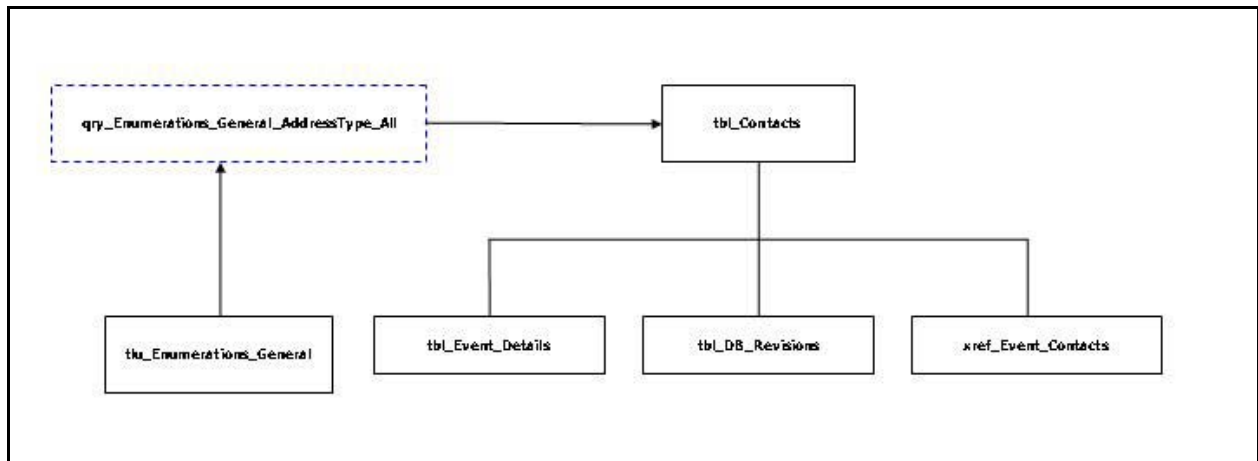
Figure 4 Relationships for tbl_Contacts

3.2.1.4 Database table: tbl_DB_Meta

This table is used to associate I & M metadata systems with the "back-end" database. Refer to the *Natural Resource Database Template Version 3 Documentation* for more details about the intended usage. This table does not connect or relate to any other table within the Natural Resources Database.

Field Name	Data Type	Size	Description
DB_Meta_ID	Replication ID	16	Unique Record Identifier
DB_Desc	Memo	-	Description of Database purpose
Meta_MID	Replication ID	16	Link to I & M NR-GIS Metadata Database
DSC_GUID	Replication ID	16	Link to I & M Dataset Catalog desktop metadatatool

Table 18 tbl_DB_Meta schema

3.2.1 5 Database table: tbl_DB_Revisions

This table is used to keep track of modifications to the structure of the "back-end" database. Revisions and modifications should be tracked faithfully once the database has been base-lined and configuration management procedures are activated. Additions should only occur when STRUCTURAL changes are made to the associated "back-end" database. Please do not use it to identify additions or modifications of the DATA in the database. This table does not connect or relate to any other table.

Field Name	Data Type	Size	Description
Revision_ID	Replication ID	16	Unique record Identifier
Revision_Contact_ID	Replication ID	16	Contact ID for the person doing the revision
DB_Meta_ID	Replication ID	16	Pointer to a tbl_DB_Meta record
Revision_Date	Date/Time	8	Database revision date
Revision_Reason	Memo	-	Reason for the database revision
Revision_Desc	Memo	-	Revision description
Revision_Major	Text	5	Major revision number or code - ex: Revision 4.31 ; 4 = Major, 31 = Minor
Revision_Minor	Text	5	Minor revision number or code - ex: Revision 4.31 ; 4 = Major, 31 = Minor

Table 19 tbl_DB_Revisions schema

3.2.1.6 Database table: tbl_Documents

Documents are referenced in several places within the 'back-end' database. In order to keep track of these references, a data table specific to documentation was added to the original design. At the present, this table serves to identify a subset of the documents identified in the National Park Service's Nature Bib repository. Only documentation SPECIFIC to the assigned usage of the "back-end" database should be entered into this table.

| Field Name	Data Type	Size	Description
Document_ID	Replication ID	16	Unique Document Identification Number
Document_Category	Text	50	Nature Bib document category
Document_Title	Text	100	Title Of This Document
Document_Date	Date/Time	8	Date Document was finished
Display_Order	Long Integer	4	Sequence Number to sort records within category for display purpose
Sensitivity_Level	Text	50	Sensitivity Level of Corresponding Document
BibKey_ID	Text	50	Nature Bib Document Identifier - Note This is created by the Nature Bib software and must be identified and entered manually

Table 20 tbl_Documents schema
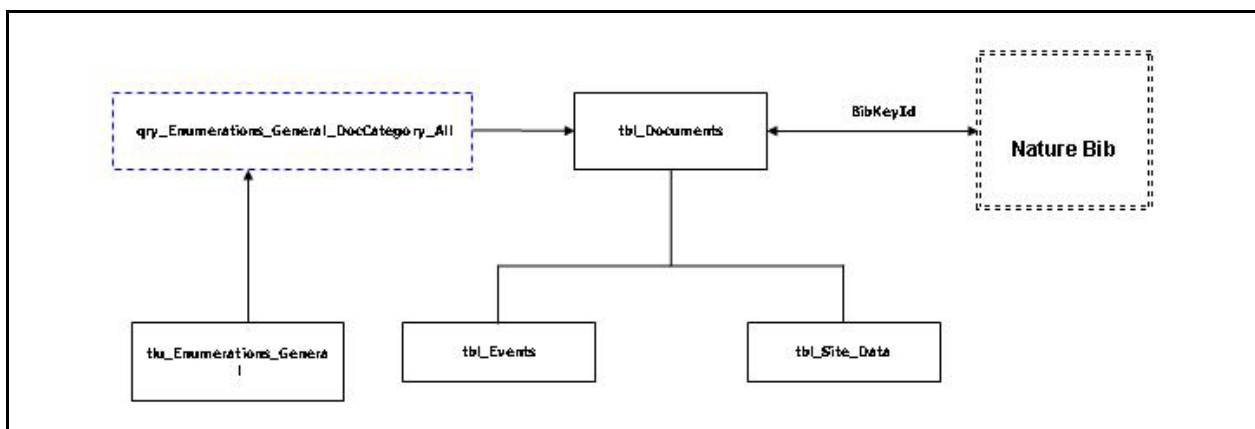
Figure 5 Relationships for tbl_Documents

3.2.1.7 Database table: tbl_Event_Details

This table is used to identify those individuals who have entered, modified or verified the Events data entered into the database. Each record in the "tbl_Events" table should have a corresponding record in this table.

Field Name	Data Type	Size	Description
Event_Details_ID	Replication ID	16	Unique Record Identifier
Event_ID	Replication ID	16	Link back to the master record in tbl_Events.
Event_Notes	Memo	-	Anything interesting or out of the ordinary that happened, or that is meaningful for the data values
Entered_By	Text	50	Individual who entered the data
Entered_Date	Date/Time	8	When the data was first entered
Updated_By	Text	50	Individual who last updated the data
Updated_Date	Date/Time	8	When the last update or verification occurred
Verified	Yes/No	1	Has the data entry for this event been verified?
Verified_By	Text	50	Individual who verified the data
Verified_Date	Date/Time	8	Date when the data was last verified.

Table 21 tbl_Event_Details schema

3.2.1.8 Database table: tbl_Event_Group

This table is derived from the table of the same name identified in *Natural Resource Database Template Version 3 Documentation*. Refer to that document for more information.

Field Name	Data Type	Size	Description
Event_Group_ID	Replication ID	16	A unique record identifier
Start_Date	Date/Time	8	Start date of the event group
End_Date	Date/Time	8	Ending date of the event group
Event_Group_Name	Text	50	Identification/name for this event group
Event_Group_Desc	Text	50	Description
Event_Group_Notes	Text	50	Notes
Event_Group_Report	Replication ID	16	Trip report, link to trip report, pointer to an entry in the tbl_Documents

Table 22 tbl_Event_Group schema

3.2.1.9 Database table: tbl_Events

This is the primary table that connects all sampling event information together, as illustrated in Figure 3 Primary data table relationships. The design of this table is based on a combination of "tbl_Events" as identified in *Natural Resource Database Template Version 3 Documentation* and some of the information identified in *Klamath Network Data Dictionary for KPN Site Information Form*. Refer to both documents for further details. An additional field, not identified in either document, has been added to identify whether or not the event or any of its associated data may be modified thru the user interface of the "front-end". This field is identified as "Locked". It is a simple boolean type field; a positive/true/yes value indicates the associated data may not be accessed by the "Data Entry" functions of the front end. This would be set

AFTER all data has been entered AND verified. The data retrieval query which is used to extract records for the Events data entry display, only extracts those records which are not marked as LOCKED. Locked records would still be available for reports or other data retrieval operations in a "read-only" fashion.

The field "Event_ID" serves as the primary index for all associated data tables, as identified in Figure 3 Primary data table relationships.

| Field Name	Data Type	Size	Description
Event_ID	Replication ID	16	Event identifier
Location_ID	Replication ID	16	Link to tbl_Locations
Event_Group_ID	Replication ID	16	Link to tbl_Event_Group
Protocol_ID	Replication ID	16	Pointer to tbl_Documents identifying the specific Protocol Document
Start_Date	Date/Time	8	Date (MM/DD/YYYY) when sampling began
Start_Time	Date/Time	8	Time sampling began (24 hour)
End_Time	Date/Time	8	Time sampling ended (24 hour)
MajorClass_Code	Text	20	Category Code For Major Class
Subclass_Code	Text	20	Category Code For Sub Class
Event_Type_Code	Text	20	Event Category Code
Encounter_Class	Text	50	Type of Sampling Survey Being Performed
Locked	Yes/No	1	Record is locked from further edits, either because of Validation/Verification or because it simply needs to be that way.

Table 23 tbl_Events schema.
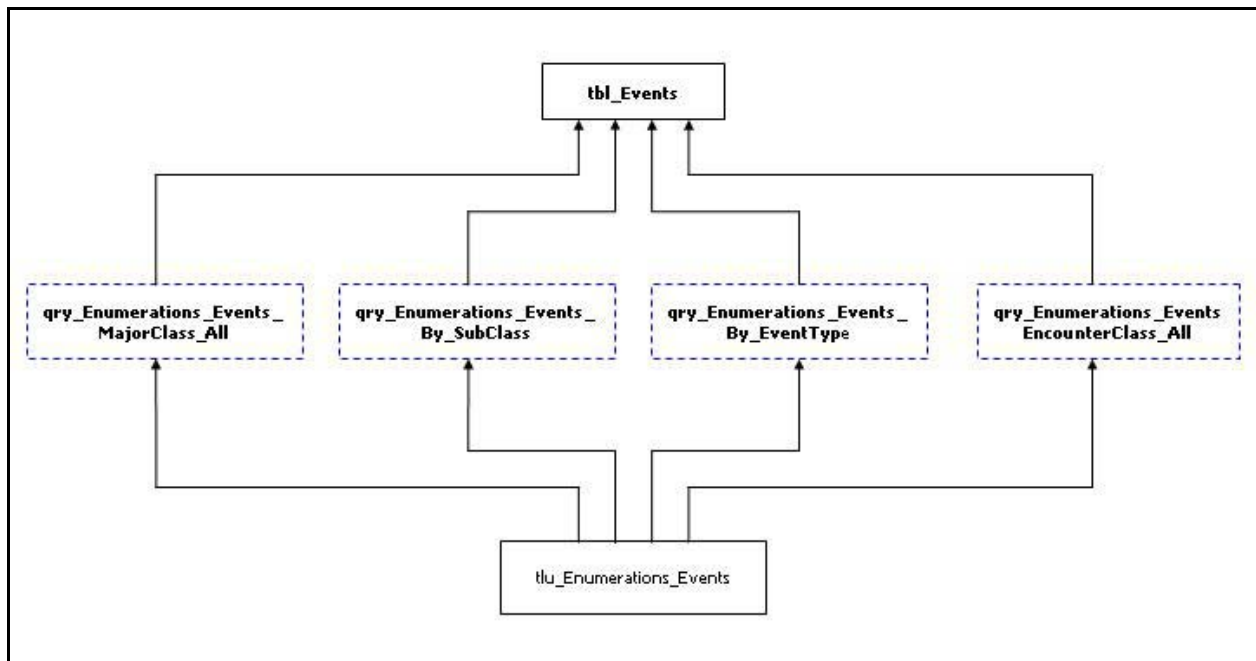
Figure 6 tbl_Events - tlu_Enumerations_Events relationships.

3.2.1.10 Database table: tbl_Field_Data

This is basically a place holder in that the Natural Resources Database is designed to be a baseline set of database tables and associated user interface displays for a wide variety of

inventory and/or monitoring projects. Each project would target a different natural resource of interest and as a result, the project specific field data will vary greatly in structure. It will be the responsibility of the Klamath Network Data Manager or project personnel to create the table to contain the specific information to be collected and create the associated data entry displays.

Any created field data table MUST contain the two fields identified in the following table, "FieldData_Id" and "Event_ID". Additional fields may be added as necessary, as well as secondary tables. Refer to Figure 3 Primary data table relationships, and the section for "tbl_Site_Data", for an example of similar structures that may be utilized for field data table design.

Field Name	Data Type	Size	Description
FieldData_ID	Replication ID	16	Unique identifier for each record.
Event_ID	Replication ID	16	Pointer to a record in the master table - tbl_Events

Table 24 tbl_Field_Data base schema

3.2.1.11 Database table: tbl_Locations

This table is used to contain information about specific locations involved in a particular inventory or monitoring project. The design is derived from the table of the same name identified in *Natural Resource Database Template Version 3 Documentation*. Extensions have been made in order to accommodate network specific information, primarily Township/Range/Section/Quadrant as identified in the *Klamath Network Data Dictionary for KPN Site Information Form*.

| Field Name	Data Type	Size	Description
Location_ID	Replication ID	16	Unique location identifier
Site_ID	Replication ID	16	Optional link to tbl_Sites
GIS_Location_ID	Text	50	Link to GIS feature, equivalent to NPS_Location_ID (recommended)
Meta_MID	Text	50	Link to NR-GIS Metadata Database (recommended if there is no GIS link)
Coord_X	Double	8	X coordinate for the point or plot center
Coord_Y	Double	8	Y coordinate for the point or plot center
Coord_Units	Text	50	Coordinate units
Coord_System	Text	50	Coordinate system used for X and Y.
UTM_Zone	Integer	2	UTM Zone
Datum	Text	50	Datum of mapping ellipsoid
Est_H_Error	Single	4	Estimated horizontal accuracy error
Accuracy_Notes	Memo	-	Comments on how horizontal accuracy was estimated
Unit_Code	Text	4	Code for the unit or park (4 letter park code)
Loc_Name	Text	50	ID for the station or transect point that defines the location within the site
Loc_Type	Text	12	Location type indicator (Not required if using tbl_Data_Locations)
Loc_Notes	Memo	-	Any additional comments about the sampling location
Elevation	Double	8	Record the elevation from GPS unit or from quad map, in meters.
Map_Township	Text	5	Township Value, commonly identified as "Txx"
Map_Range	Text	5	Range Value, commonly identified as "Rxx"
Map_Section	Text	5	Section Value, commonly identified as "Sxx"
Map_Quadrant	Text	50	Identifies the quarter of the Section
GPS_Setup_OK	Yes/No	1	Indicates whether or not the GPS was correctly programmed for mandatory zone and datum.
Updated_Date	Text	50	Date of entry or the last change (recommended)

Table 25 tbl_Locations schema.
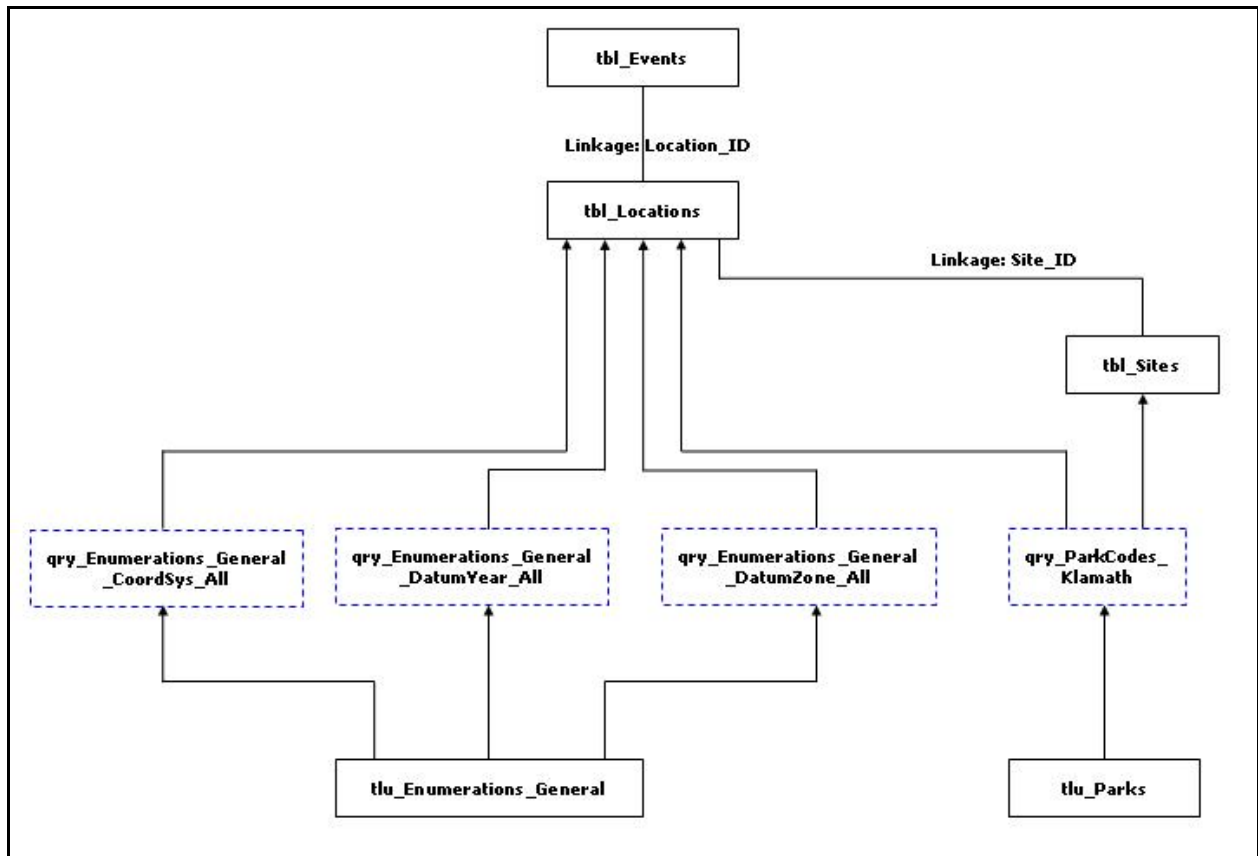
Figure 7 Relationships for tbl_Locations and tbl_Sites

3.2.1.12 Database table: tbl_Site_Data

This table is used as the root table for documenting the environment at a particular sampling site and at a particular date and time and is directly linked to a "tbl_Events" record thru the "Event_ID" field. Connections between records in this table and associated, secondary tables is thru the "SiteData_ID" field as depicted in Figure 3 Primary data table relationships, The design of this table was derived from the information identified in the *Klamath Network Data Dictionary for KPN Site Information Form*.

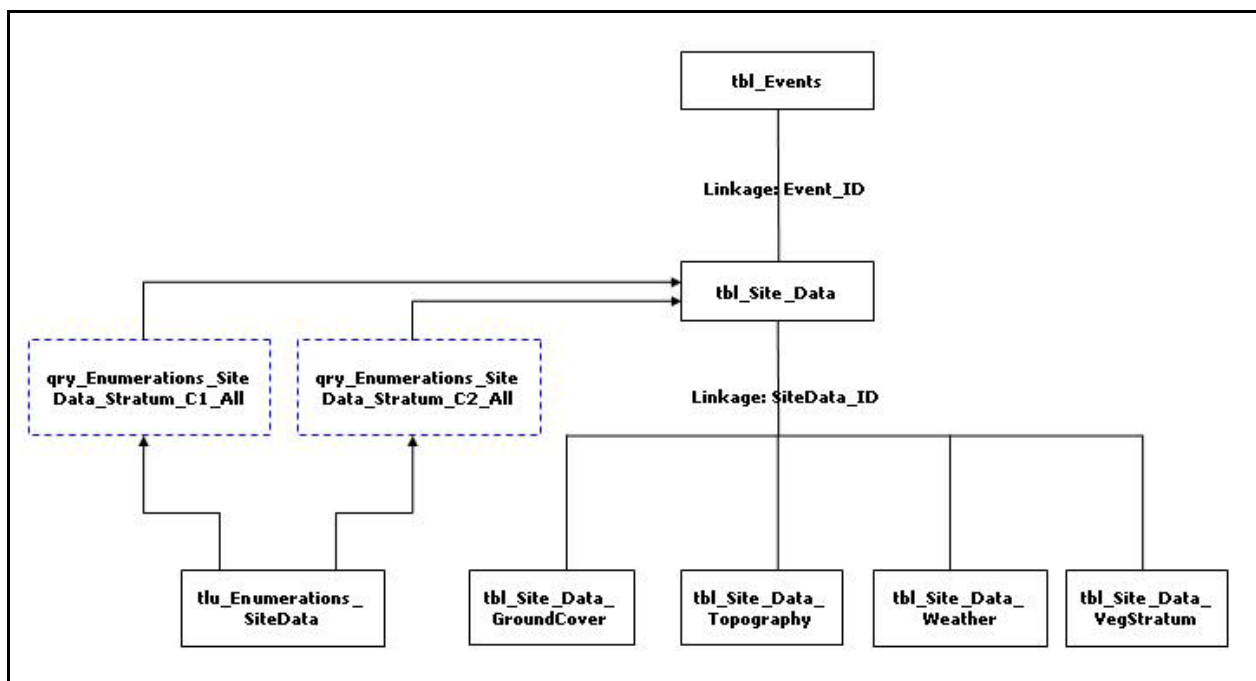| Field Name	Data Type	Size	Description
SiteData_ID	Replication ID	16	Unique identifier for each record.
Event_ID	Replication ID	16	Pointer to a record in the master table - tbl_Events
Hydrology	Text	255	Type of surface water found within survey site.
Stratum_Class_1	Text	255	Elevation Zone from Network elevation zone key
Stratum_Class_2	Text	255	Climate Zone from Network climate zone map
Map_Available	Yes/No	1	Is a map Available???
Image_Available	Yes/No	1	Is an Image Available???
Sketch_Available	Yes/No	1	Is a Sketch Available???
Image_ID	Text	50	BIB KEY ID Pointer to tbl_Documents identifying an image of the site, blank if no image
Sketch_ID	Text	50	BIB KEY ID Pointer to tbl_Documents identifying a sketch of the site, blank if no sketch
Description_Site	Text	255	A general description of the sample site, if needed.
Description_Access	Text	255	Description of any special directions getting to this sample site, if needed.

Table 26 tbl_Site_Data schema.

Figure 8 Relationships for tbl_Site_Data

3.2.1.13 Database table: tbl_Site_Data_GroundCover

Field Name	Data Type	Size	Description
SiteData_GC_ID	Replication ID	16	Unique Record Identifier
SiteData_ID	Replication ID	16	Pointer to Master record in tbl_Site_Data
Bedrock_Boulder	Double	8	Site has exposed bedrock or large boulders (stones > 10cm diameter).
Gravel_Cobble	Double	8	Site has small igneous rock, typically smooth and round, between 2mm and 10 cm in diameter.
Sand_Soil	Double	8	Site is composed of sand or bare soil.
Talus	Double	8	Site is covered by angular rock larger than gravel or cobble but smaller than boulders.
Bryophyte_Lichen	Double	8	Site is composed of bryophytes or lichens.
Herbaceous	Double	8	Site has herbaceous plants.
Ferns	Double	8	Site is composed of ferns.
Grass_Litter	Double	8	Site is composed of dead grass litter.
Mosses	Double	8	Site is composed of mosses.
Leaf_Litter	Double	8	Site is composed of dead leaves.
WoodDebris	Double	8	Site is composed of twigs, limbs, bark or other wood material.

Table 27 tbl_Site_Data_GroundCover schema

3.2.1.14 Database table: tbl_Site_Data_Topography

Field Name	Data Type	Size	Description
SiteData_Topo_ID	Replication ID	16	Unique identifier for each record.
SiteData_ID	Replication ID	16	Pointer to Master record in tbl_Site_Data
Plot_Shape	Text	255	Geometric shape of the study or sampling site, to the best of your ability.
Plot_Width	Double	8	Distance, in meters, of the shortest axis of the survey area.
Plot_Length	Double	8	Distance, in meters, of the longest axis of the survey area.
Slope_Gradient	Double	8	Percent slope or gradient, facing down slope using a clinometer.
Aspect	Double	8	Aspect in compass degrees in degrees facing long axis of sample area
Topography	Text	255	General topography of the site
Slope_Shape	Text	255	General shape of the slope in an x/y axis.
SurfaceWater	Double	8	Record the amount of surface water found within sample site.

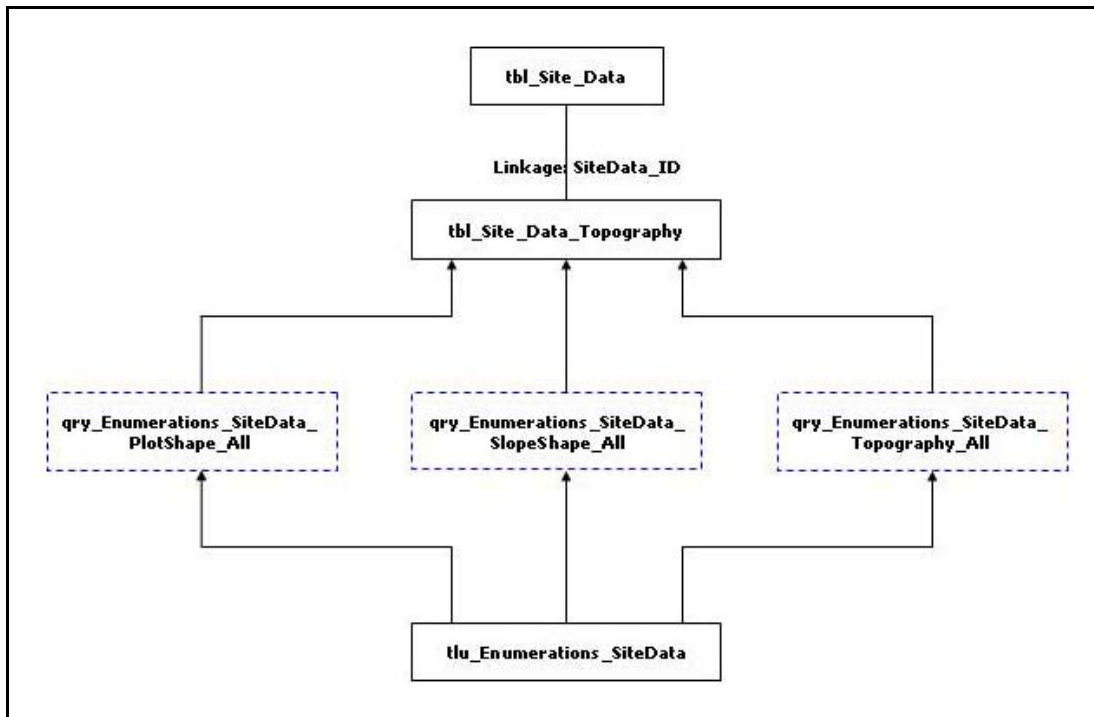**Table 28 tbl_Site_Data_Topography schema.**

Figure 9 tbl_Site_Data_Topography - tlu_Enumerations_SiteData relationships.

3.2.1.15 Database table: tbl_Site_Data_VegStratum

The "tbl_Site_Data_VegStratum" is used to record the observed vegetation strata at a particular field site. There are four (4) layers that may be observed. The type of information collected for each layer, or strata are identical and are repeated four times in the table design and are identified by the field preface lettering as follows:

- "Canopy_"
- "SubCanopy_"
- "Shrub_"
- "Herbs_"

Refer to Table 29 tbl_Site_Data_VegStratum schema and Figure 10 tbl_Site_Data_VegStratum - tlu_Enumerations_SiteData relationships for further design information.

Field Name	Data Type	Size	Description
SiteData_VS_ID	Replication ID	16	Unique Record Identifier
SiteData_ID	Replication ID	16	Pointer to Master record in tbl_Site_Data
Phenology_TreesShrubs	Text	255	Tree and shrub types based upon the leaves found in overstory.
Phenology_Herbs	Text	255	Herbaceous plant's life cycle length.
Physiognomic_Class	Text	255	Physiognomy of dominant vegetation at site.
Canopy_HeightClass	Text	15	Estimated height of most dominant 3 species of canopy trees.
Canopy_PercentCover	Text	255	Estimated percent of area is covered by most dominant 3 species of canopy trees.
Canopy_Species_1	Text	255	Record Latin name of Predominant tree species.
Canopy_Species_2	Text	255	Record Latin name of second most dominant tree species.
Canopy_Species_3	Text	255	Record Latin name of third most dominant tree species.
SubCanopy_HeightClass	Text	15	Height of subcanopy tree layer.
SubCanopy_PercentCover	Text	255	Cover of subcanopy tree stratum class.
SubCanopy_Species_1	Text	255	Record Latin name of Predominant subcanopy species.
SubCanopy_Species_2	Text	255	Record Latin name of second most dominant subcanopy species.
SubCanopy_Species_3	Text	255	Record Latin name of third most dominant subcanopy species.
Shrub_HeightClass	Text	15	Height of each vegetation stratum class
Shrub_PercentCover	Text	255	Cover of shrub stratum class.
Shrub_Species_1	Text	255	Record Latin name of Predominant shrub species.
Shrub_Species_2	Text	255	Record Latin name of second most dominant shrub species.
Shrub_Species_3	Text	255	Record Latin name of third most dominant shrub species.
Herb_HeightClass	Text	15	Height of herbaceous stratum class.
Herb_PercentCover	Text	255	Cover of herbaceous stratum class.
Herb_Species_1	Text	255	Record Latin name of Predominant herbaceous species.
Herb_Species_2	Text	255	Record Latin name of second most dominant herbaceous species.
Herb_Species_3	Text	255	Record Latin name of third most dominant herbaceous species.
Description_Vegetation	Text	255	A general description of the vegetation found within the sample site.

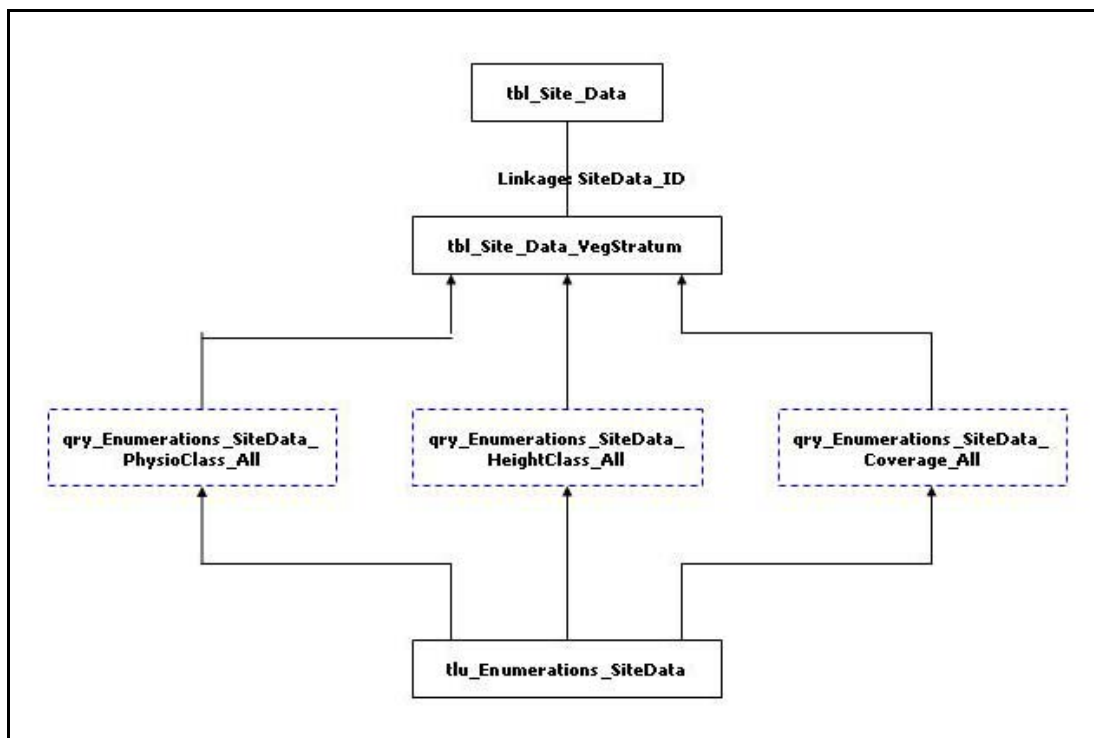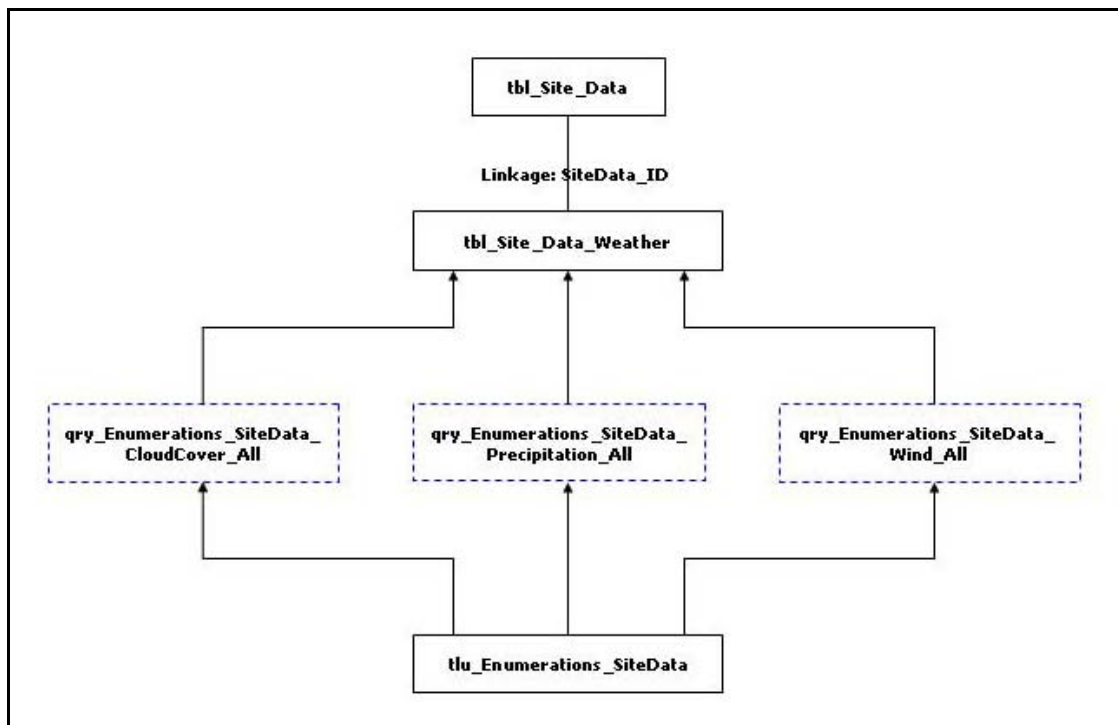**Table 29 tbl_Site_Data_VegStratum schema.**

Figure 10 tbl_Site_Data_VegStratum - tlu_Enumerations_SiteData relationships.

3.2.1.16 Database table: tbl_Site_Data_Weather

This table is used to store weather related information that was observed at the time of field operations. Referring to Figure 11 tbl_Site_Data_Weather - tlu_Enumerations_SiteData relationships, this table is linked to "tbl_Site_Data" thru the pointer "SiteData_ID" and several fields receive data values or enumeration constants from "tlu_Enumerations_SiteData". These fields are NOT linked to this table, but are supplied with values from the enumerations table via data entry display.

Field Name	Data Type	Size	Description
SiteData_Wx_ID	Replication ID	16	Unique Record Identifier
SiteData_ID	Replication ID	16	Pointer to Master record in tbl_Site_Data
Cloud_Cover	Text	255	Amount of Cloud Cover at time the time of sampling survey.
Precipitation	Text	255	Type of Precipitation at the time of the sampling survey.
Wind_Speed	Text	255	Wind characteristic at the time of sampling survey. Wind characteristic at the time of sampling survey.
Temp_Air	Text	255	Ambient air temperature in degrees Celsius at time of sampling survey.
Temp_Soil	Text	255	Soil temperature at 1 cm depth in degrees Celsius at time of sampling survey.
Relative_Humidity	Text	255	Relative Humidity in percent, measured with instrument, at the time of survey.

Table 30 tbl_Site_Data_Weather schema.

Figure 11 tbl_Site_Data_Weather - tlu_Enumerations_SiteData relationships.

3.2.1.17 Database table: tbl_Sites

This table is used to contain information about larger sampling areas involved in a particular inventory or monitoring project. The design is derived from the table of the same name identified in *Natural Resource Database Template Version 3 Documentation*. For each record in this table there may be anywhere from zero to multiple records in `"tbl_Locations"` which links to this table via the pointer `"Site_ID"`.

Field Name	Data Type	Size	Description
Site_ID	Replication ID	16	Unique record identifier
GIS_Location_ID	Long Integer	4	Link to GIS feature, equivalent to NPS_Location_ID
Site_Name	Text	100	Name of the site or general area
Site_Desc	Text	255	Description of the area, if just a name is not adequate.
Unit_Code	Text	12	Park, Monument or Network Code
Site_Notes	Memo	-	General notes on the site.

Table 31 tbl_Sites schema.

3.2.1.18 Database table: xref_Event_Contacts

The `"xref_Event_Contacts"` table is used to associate personnel with particular sampling events. This table exists in a many-to-one relationship with `"tbl_Events"`, that is to say, one `"tbl_Events"` record can associate with many `"xref_Event_Contacts"` records. Each `"xref_Event_Contacts"` record contains a record pointer back to a record in `"tbl_Events"` and a second pointer to a record in the `"tbl_Contacts"` table, which represents a particular individual. This is depicted in Figure 3 Primary data table relationships, and in Figure 6 Relationships for xref_Event_Contacts.

| Field Name	Data Type	Size	Description
Record_ID	Long Integer	4	Unique record identifier
Event_ID	Replication ID	16	Pointer to record in Master Table tbl_Events
Contact_ID	Replication ID	16	Pointer to Record in tlu_Contacts
Contact_Role	Text	50	Activity Role extracted by query from the tlu_Enumerations_General table identifying the primary role of this individual in the sampling event

Table 32 xref_Event_Contacts schema
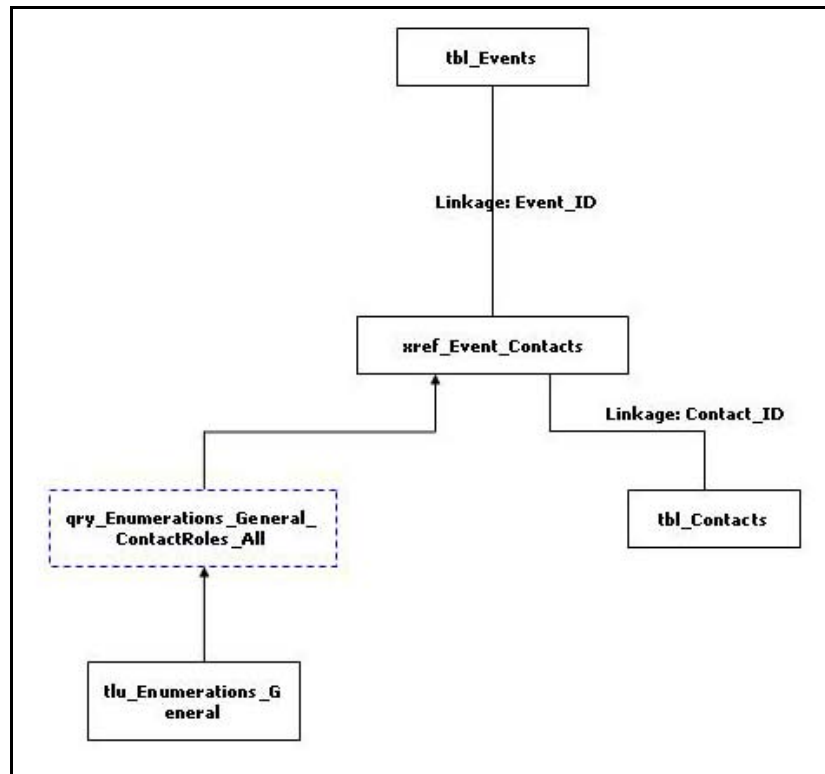
Figure 12 Relationships for xref_Event_Contacts

4 Notes

5 References

Several documents are useful for the full understanding of the design, operation, and modification of both the "back-end" database as well as the "front-end" user interface.

Klamath Network Data Dictionary for KLMN Site Information Form, 2000, National Park Service, Inventory and Monitoring Program, Klamath Network Office, Ashland OR.

Klamath Network Database Template Project Identification Types (version 5), 2003, National Park Service, Inventory and Monitoring Program, Klamath Network Office, Ashland OR.

Klamath Network Natural Resources Database - Software User Manual, 2005, National Park Service, Inventory and Monitoring Program, Klamath Network Office, Ashland OR.

Klamath Network Natural Resources Database - Software Version Description, 2005, National Park Service, Inventory and Monitoring Program, Klamath Network Office, Ashland OR.

Klamath Network Site Information Form, 2000, National Park Service, Inventory and Monitoring Program, Klamath Network, Ashland OR.

Natural Resource Database Template Version 3 Documentation, 2004, National Park Service, Washington Area Service Office, Inventory and Monitoring Program, Ft. Collins CO.